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AMSAT's Newsletter for the Amateur Radio Space Program

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Say Progress Good In AO-10 Recovery Efforts

Efforts aimed at saving AO-10 made good progress recently when results of testing yielded encouraging results. Based on location of specific failure zones within the radiation-damaged IHU memory, Karl Meinzer, DJ4ZC, was able to load a new version of the IPS operating system. This opens the door for further progress and it is anticipated that higher level operational software can soon be loaded. This could be significant in the recovery efforts if the attitude maneuver routines can be loaded and executed. Survival of the spacecraft is coupled to ground controllers' ability to keep the satellite's orientation to the sun within certain bounds.

Pacing the recovery effort was an interval of poor satellite visibility from DJ4ZC's Marburg, West Germany QTH lasting from the first through the second week of July. According to recent communications between command stations, the re-written operating system, IPS-C4, avoids certain memory rows which have been found to be damaged. It had been previously found that the IHU would "crash" when executing corrupted code from those locations. If, as hoped, normal spacecraft operation can be restored in a few weeks, the reduction in overall usable memory may reduce or eliminate some functions such as the RTTY or CW telemetry program. But important routines will apparently work within the bounds of the memory map now defined. Based on current planning, key high-level routines may be loaded around mid-July when good visibility returns to Marburg.

If these forecasts hold and no further difficulties are encountered, it may be possible to program some transponder operations on a modest scale later in July.

For the first time since the mid-May failure hobbled the world's only high orbiting OSCAR there is a factual basis for optimism. The ability to load IPS-C4 opens the door to numerous options which were precluded as recently as a week ago. Diagnosis of the failure and isolation of usable memory zones has proven to be the roadmap on the comeback trail for AO-10.

Beyond these encouraging developments, however, is the sobering reality of the situation. AO-10 has suffered serious radiation damage. It remains hypothetical whether any or all of the damage is reversible. One line of thinking allows that if the IHU is powered down, the accumulated charge in the memory IC depletion region will bleed off and much of the memory's functionality should return. However, powering down the IHU could itself be a fatal miscalculation.

There is no "big switch" on board to exercise; the only means of powering down the IHU would be to place the spacecraft in a poor sun angle such that the solar cell power production would cease, the battery would be depleted and the spacecraft would be effectively dead. The risk is that it probably would never recover at all from such a stratagem. Indeed, experts suggest many approaches might be opted here.

For example, if the objective is to provide continuity of transponder service until Phase 3C is up and running next year, the best tactic might be to try to stretch the AO-10 IHU memory life further by simply repeatedly compacting IPS with progressively shrinking memory resources. Then, after P3C is operational, engage the more risky protocol (power down) on AO-10.

On the other hand, if the objective is to attempt to rejuvenate the memory even at the risk of total, prompt, permanent loss of AO-10, then the power down option might be selected. With the return of some controllability, the second option now seems possible. Without controllability, however, power down would inevitably occur but not at a time of AMSAT's choosing.

AO-10 is not currently available for operation on either transponder. If satisfactory progress in recovery continues, limited transponder use may be authorized in August or sooner.

JAS-1 Launch On Schedule; ALINS Coverage Announced

AMSAT will support an AMSAT Launch Information Network Service (ALINS) operation for the launch of JAS-1, the Japanese Amateur Radio League (JARL) satellite. The launch will take place from the Japanese island of Tanegashima on 31 July at 2030 UTC. ALINS coverage began on 4 July.

ALINS will feature three phases: Pre-launch advisories and nets; realtime launch and separation coverage; post-launch

advisories and nets.

For the pre-launch phase, JAMSAT President Harry Yoneda, JA1ANG, will compile pre-launch advisories from information available from JARL and NASDA, the Japanese launch authority. These advisories will be TELEXed to Ralph Wallio, WØRPK, AMSAT Vice President of Operations. Ralph will then refile the reports to various AMSAT media such as AMSAT's electronic mail system called Telemail and to various dial-in and packet radio bulletin boards.

WEEKLY ADVISORIES will be sent by JA1ANG on Fridays (U.S. time) starting 04 July and continuing through 25 July. They will be transferred to Telemail for inclusion in the AMSAT News Service weekly releases. The weekly advisories will be included in all AMSAT net operations.

In the days leading up to launch, the reporting pace will quicken. DAILY ADVISORIES will be sent by JA1ANG starting Monday, 28 July and continuing to launch day, Thursday 31 July. They will be transferred to Telemail by WØRPK as soon as possible to allow for timely dissemination.

The WEEKLY and DAILY ADVISORIES will be available via AMSAT Telemail to affiliated AMSAT stations worldwide for nets for their areas.

Special 75 meter AMSAT net sessions will be held on Monday 28 July and Wednesday 30 July. The usual Tuesday evening net session will be held on schedule 29 July. The 75 meter frequency is 3857 kHz.

REALTIME launch coverage begins on launch day, 31 July (U.S. time). Coverage will start with hf net check-ins at 1930 UTC. Teleconference linking of all net stations will begin at 2000 UTC. Nets will be active on 20 and 40 meters. Frequencies planned for use include 14282, 14295, 7185 and, if 15 meters is open, 21390 kHz. JA1ANG in Japan will be included in the teleconference to provide a first-hand description of launch and boost phases.

Teleconference and net operations will continue with separation and first beacon reports from South America at 2132 UTC. These reports and a wrap-up of events will conclude the realtime coverage at 2200 UTC.

POST-LAUNCH ADVISORIES will be sent by JA1ANG on Friday, Saturday and Sunday (August 1st to 3rd) as necessary. Special 75 meter AMSAT nets will be held on Thursday and Friday evenings to distribute Keplerian elements, satellite information and to recap launch coverage. Information will continue to be available through the weekend on the 20 meter South Pacific AMSAT net (Saturday 14.282 MHz 2200 UTC) and the Sunday 20 meter net (14.282 MHz 1900 UTC).

Here is this week's JAS-1 advisory from JA1ANG:

"The current JAS-1 launch schedule is 31JUL86 at 2030UTC. This schedule may change as late as 48-hours before the actual launch date and time.

"JAS-1 separation from the H-1 second stage is scheduled to occur 01H 02M 07S after lift off at a height of 1503 Km at 20S latitude and 53W longitude (overhead of Chile in South America)."

Keplerian elements for JAS-1 were provided in *ASR* 126/127.

OSCAR Ø Packet Radio Breakthrough

Tom Clark, W3IWI, says he's become the first to receive packets bounced off the moon (OSCAR Ø). Tom is currently in Fairbanks, Alaska on a temporary assignment for NASA where he is doing radio-astronomy work. He has occasional access to a 65 foot dish antenna and recently put it to use on 432 MHz. With 100 watts he was able to copy his own packets very well after the round trip to the moon. But when trying to connect with Dave, XE1TU, using a 20 foot dish, success eluded the pair. Given some time to work out the hitches, Tom and Dave are certain they can connect via packet via OSCAR Ø!

Phase 3 Launch Delayed Until 1987

Arianespace has told *ASR* that the problems which caused the recent loss of the V-18 mission 30 May will delay the next launch, V-19, until first quarter 1987. The problem is a complex one associated with the problem-plagued HM7B third stage cryogenic engine built be S.E.P. of France.

In a news conference in Paris 7 July led by Arianespace Chairman Frederic d'Allest, the news of a launch stand down until early next year was not surprising despite earlier reports that launches might resume late in 1986. The HM7B also caused the failure of the V-15 mission on 12 Sept. 86 and the V-5 mission on 9 Sept. 82. There were no plans to re-order the launch sequence according to d'Allest "Except in an emergency situation" and after consultations with all affected parties.

This likely means AMSAT's Phase 3C spacecraft will be launched in 3rd or 4th quarter 1987.

The HM7B is a cryogenic stage using liquid oxygen (LOX) and liquid hydrogen (LH) in a state-of-the-art system. The stage is 9.9 meters (32.4 feet) long and 2.6 meters (8.5 feet) in diameter. It carries 10.7 metric tons (23,580 lbs.) of LOX and LH propellant. The stage delivers 63 kN thrust in a vacuum. The nominal flight time is 720 seconds and the specific impulse is 444 seconds. The engine is gimbal-mounted on a truncated thrust frame allowing control in pitch and yaw axes. The cryogenic stage is used where maximum launcher energy is required.

However, advancing the state of the art to include this technology has proven difficult. NASA recently cancelled the shuttle/Centaur stage which also uses the LOX/LH system. NASA said the decision to cancel the Centaur was made on the grounds of safety; it would simply cost too much to upgrade Centaur to shuttle safety requirements. Nevertheless, overall performance risk and awareness of the problems with the HM7B likely entered the shuttle/Centaur cancellation decision process sources indicate.

The V-15 failure last September had earlier been attributed to a leak in the third stage propulsion system. According to an Arianespace Washington spokesperson, it is now apparent the leak in an HM7B injector nozzle precooled the stage's engine and prevented correct ignition. The spokesperson said the base cause in all three HM7B incidents is the apparent hyper-sensitivity of the stage to changes in its operating conditions; there is an intolerably narrow range over which proper ignition and sustained operation will occur.

According to AMSAT VP of Engineering, Jan King, W3GEY, problems with the HM7B are particularly resistant to solution. "The problem" he earlier remarked about the V-15 failure, "Is that we can't adequately model the dynamics. The turbulence modeling ability of currently available

mathematical tools is wholly inadequate to the task of finding out what is going on." It is known that modeling large-scale dynamic systems involving turbulence (such as weather prediction) are currently inadequate except when major, often seriously compromising, simplifications are made. Often these simplifications account for the divergence of the theoretical model and actual performance; the reason weather prediction is an inexact science.

Further exacerbating the situation, in ground tests of the stage at full atmospheric pressure engineers are obliged to extrapolate results to a vacuum; the environment in which the stage is required to perform. But the engine does not perform at ground level as it does in space. Moreover, besides the complications of testing at 1 atmosphere, there are the issues of temperature, acceleration and other differences between the test and operational environments. Engineers are thus left with the dilemma of being mostly unable to mathematically model the system as it performs in flight and wholly unable to test it in a realistic environment on the ground.

Ariane has experienced a total of four failures of 18 attempts. The first failure was that of V-2 on 23 May 80; a day called Black Friday in AMSAT annals in that V-2 carried AMSAT's Phase 3A to a watery grave just off Devils Island, a few miles from the French Guiana launch site.

Mode L ZRO Test Bonanza Demonstrates Superior Performance

The 11 May ZRO-Memorial Receive Sensitivity Test, a component of AMSAT's Technical Achievement Award Program, for the first time featured a Mode L segment. Now the results have been scored and there are some truly sterling performances in the report. Three stations managed to pull off a perfect Z8 rating in their first try at Mode L. A Z8 rating means each was able to copy the test signal 24 dB below the Mode L General Beacon. (Each Z increment represents -3 dB; Z8 is 8 times -3 dB or -24dB referenced to the beacon.) Those achieving this superlative level were: WA3WBU, K9NO and LU8EBH.

Only one Mode B Z8 has ever been achieved. K7ID managed that feat earlier this year. This might be taken as an additional indicator of how good performance on Mode L can be. Sky noise on the Mode L downlink (436 MHz) is only about 30 degrees K, average, compared to the sky noise at Mode B (145 MHz) which averages close to 1,000 degrees K. Given a GaAsFET preamp at the antenna with noise figure of about 0.5 dB (35 degrees K), sky noise is roughly comparable to the receiver noise. On Mode B, by comparison, sky noise at 1,000 degrees K (6.5 dB) virtually clobbers one's receiver overwhelming a good front end (say 0.3 dB) by a wide margin.

Maximum path loss on the Mode B downlink can be up to 168 dB. On the Mode L downlink loss can reach 178 dB. However, despite the higher path loss, Mode L performance can be expected to far outstrip Mode B for several reasons. Not only is Mode L superior because of the much lower sky noise and consequent higher relative "brightness" of the source (AO-10) compared to the background clutter, but Mode L excels because of other factors. AO-10 Mode L ERP is higher; there's more antenna gain available. Also, more antenna gain is easily attainable on the ground. Whereas most Mode B users employ 2 meter antennas with gains in the vicinity of 11 dBic, Mode L receive antennas normally provide 14 dBic or more.

Figure of merit, G/T, is measured in dB per degree Kelvin or simply dB/K. The higher the G/T, the better the system can "hear". The G is antenna gain in dB. Increasing gain increases G/T. Decreasing noise temperature increases G/T. "Ts" is the system noise temperature.

Increased path loss notwithstanding, the benefits of low sky noise, higher source ERP and higher receive system performance (G/Ts) on Mode L combine to mean Mode L will soon become the Mode of choice for a growing proportion of OSCAR users.

New Dial-Up Bulletin Board Now On-Line

A new dial-in bulletin board service has been established by Ralph Wallio, WØRPK, AMSAT Vice President of Operations. The bulletin board carries the latest AMSAT news and orbital data. Also included are facilities for bulletins, questions/answers posted by OSCAR operators and private electronic mail between users.

Users will require either a 103-type modem for 300 baud service or a 212-type modem for 1200 baud service. The modem should be connected to a local telephone line and your ASCII terminal. New users must be authorized by the System Operator (SYSOP) after their first contact. Please leave the requested information plus a message to the SYSOP containing amateur call, mailing address and telephone number. Authorization will take up to 24-hours.

The bulletin board is located in central Iowa and can be accessed through the telephone system at 515-961-3325.

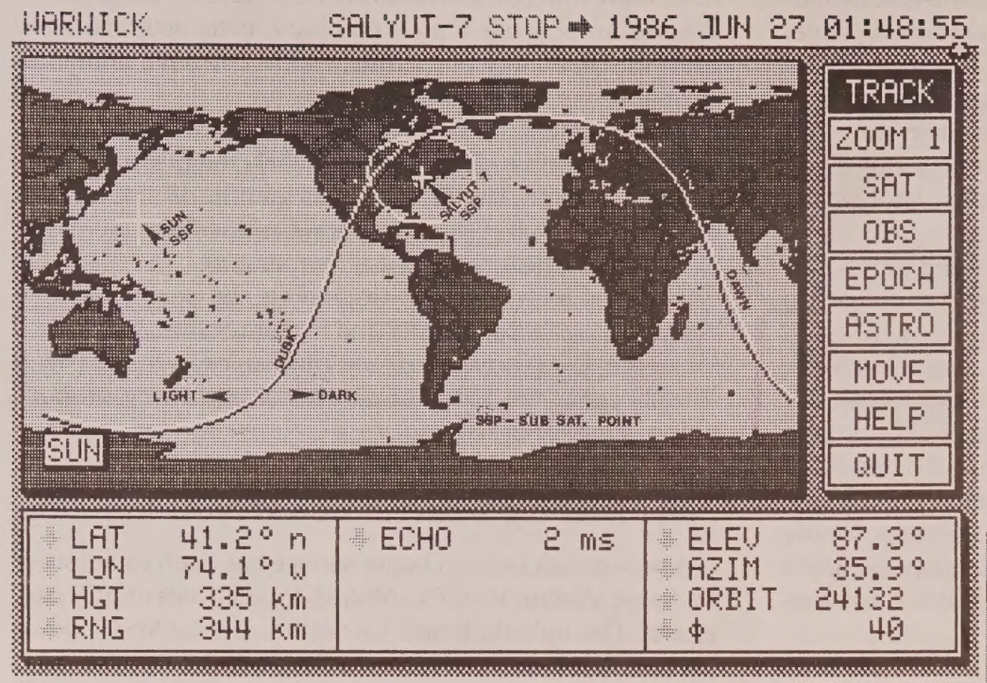
Users are encouraged to provide wider dissemination of AMSAT information offered by this service by relaying what they find to packet radio and other Amateur Radio bulletin boards.

Amateur Satellite Report Sent To All AMSAT Members

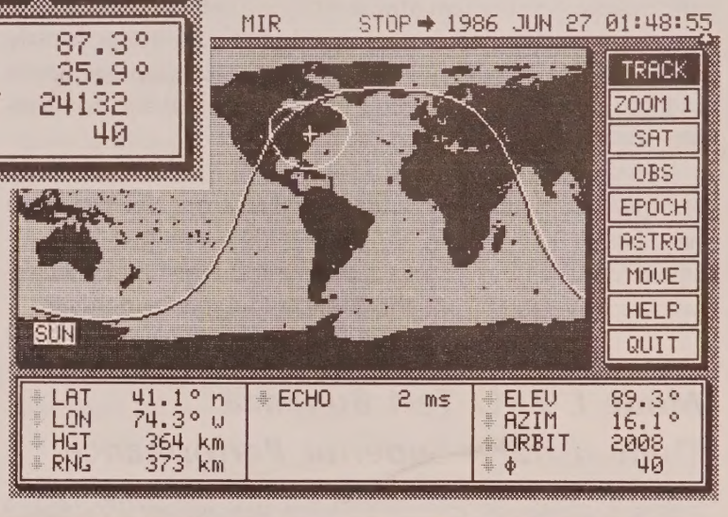
ASR is now AMSAT's flagship publication. Seven thousand copies of *ASR* 126/127 were printed and distributed to all AMSAT members worldwide. Although maximum effort has been made to insure prompt delivery to all members, as might be anticipated in a major transition, there can be occasional glitches in the initial mailings.

Besides the transition from *Satellite Journal* to *ASR*, AMSAT's computerized membership data base has been thoroughly modernized and upgraded. Tom Clark, W3IWI, and Martha Saragovitz, Director of Administration, have spent several months preparing the new data base management system which is now on-line.

Despite their yeoman efforts, however, occasional errors may occur. If you note an error in your new mailing label, please send the label to AMSAT Headquarters so corrections may be made. Also, since AMSAT will be mailing under interim permits while the postal authorities review its regular permit application, some delays in receipt may be unavoidable. Please allow extra time for receipt of your *ASR* during this transition period.



Visual observation of low earth orbit objects is becoming quite popular among AMSAT members. Superb conditions were present on June 27 UTC when MIR and Salyut 7 passed virtually overhead of WA2LQQ's Qth. These computer generated maps show the event. MIR and Salyut 7 were observed in trail about 20 minutes of arc (about 0.9 seconds in time) apart. Compare the MIR and Salyut 7 plots. Graftrak software by Silicon Solutions, Houston, available for the IBM pc developed these printouts.



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Special Premiums Soon Available; Catalog Too!

AMSAT will shortly have a new catalog of premiums available. The catalog covers such niceties as the new ballcaps, AMSAT rubber stamps and a new, gorgeous 25th anniversary patch. The patch is, according to AMSAT President WA2LQQ, "The most beautiful I've seen; better even, I think, than the stunning NASA/Apollo patches that have been available from time to time." Dick Beers, WD9IIC, developed the design and had the patch manufactured by the same company that makes the patches for NASA. In limited supply, the new patches cost $5 each from AMSAT HQ. Add $0.50 for postage. AMSAT, P.O. Box 27, Washington, D.C. 20044. Send SASE for catalog of other items available.

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